

LEPEOPHTHEIRUS SPATHA, A NEW SPECIES OF
COPEPOD (SIPHONOSTOMATOIDA: CALIGIDAE)
PARASITIC ON THE CALIFORNIA HALIBUT FROM
SANTA MONICA BAY, CALIFORNIA

Masahiro Dojiri and Robert A. Brantley

Abstract. — *Lepeophtheirus spatha*, new species, is described from the external body surfaces of the California halibut *Paralichthys californicus* (Ayers) collected in Santa Monica Bay, California. The female differs from females of its congeners by the possession of a combination of characters including posterior processes on the genital complex, truncate sternal furcal tines, and a subtriangular leg 5. It appears to be most closely related to *L. paralichthydis* Yamaguti & Yamasu, 1960 which was collected from the body surfaces of *Paralichthys olivaceus* (Temminck & Schlegel) from Japan.

The Environmental Monitoring Division, Bureau of Sanitation, City of Los Angeles, assesses the dilution, movement, and environmental effects of treated effluent discharged into the waters of the Santa Monica Bay, an open coastal embayment bordered by Point Dume to the north and Palos Verdes Point to the south. As part of the monitoring program, the Biology Laboratory conducts quarterly otter trawls which involve the identification, enumeration, length and biomass measurements of demersal fishes and macroinvertebrates at ten designated stations. During the July and November 1989 and February 1990 trawls, several specimens of the parasitic copepod family Caligidae were collected from the body surfaces of the California halibut *Paralichthys californicus* (Ayers). These parasites represent a new species of *Lepeophtheirus* which is described below.

Materials and methods. — The copepods were preserved in 70% ethanol, then cleared in 85% lactic acid for a period of at least 24 hours. They were then measured with an ocular micrometer, and selected specimens were dissected on wooden slides (Humes & Gooding 1964). Illustrations were drawn with the aid of a drawing tube attached to

a Nikon Optiphot, HFX-II. Type specimens have been deposited in the Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560. Dissected specimens remain in the collection of the first author.

Systematic Account

Order Siphonostomatoida Thorell, 1859
Family Caligidae Burmeister, 1835
Genus *Lepeophtheirus* Nordmann, 1832
Lepeophtheirus spatha, new species
Figs. 1-5

Material examined. — From external body surface of California halibut *Paralichthys californicus* (Ayers) collected in Santa Monica Bay, California, by the Biology Laboratory, Environmental Monitoring Division, City of Los Angeles: 1 female holotype (USNM 244345) and 20 paratypes (15 females, 3 males, and 1 pair in amplexus; USNM 244346; 1 male dissected on slide) from station A4, 33°34'24"N, 118°31'34"W, in 15 m, on 20 Feb 1990; 3 females (1 dissected) from station C1, 33°59'49"N, 118°42'50"W, in 60 m, on 31 Jul 1989; 2 females and 1 male (dissected on slide) from

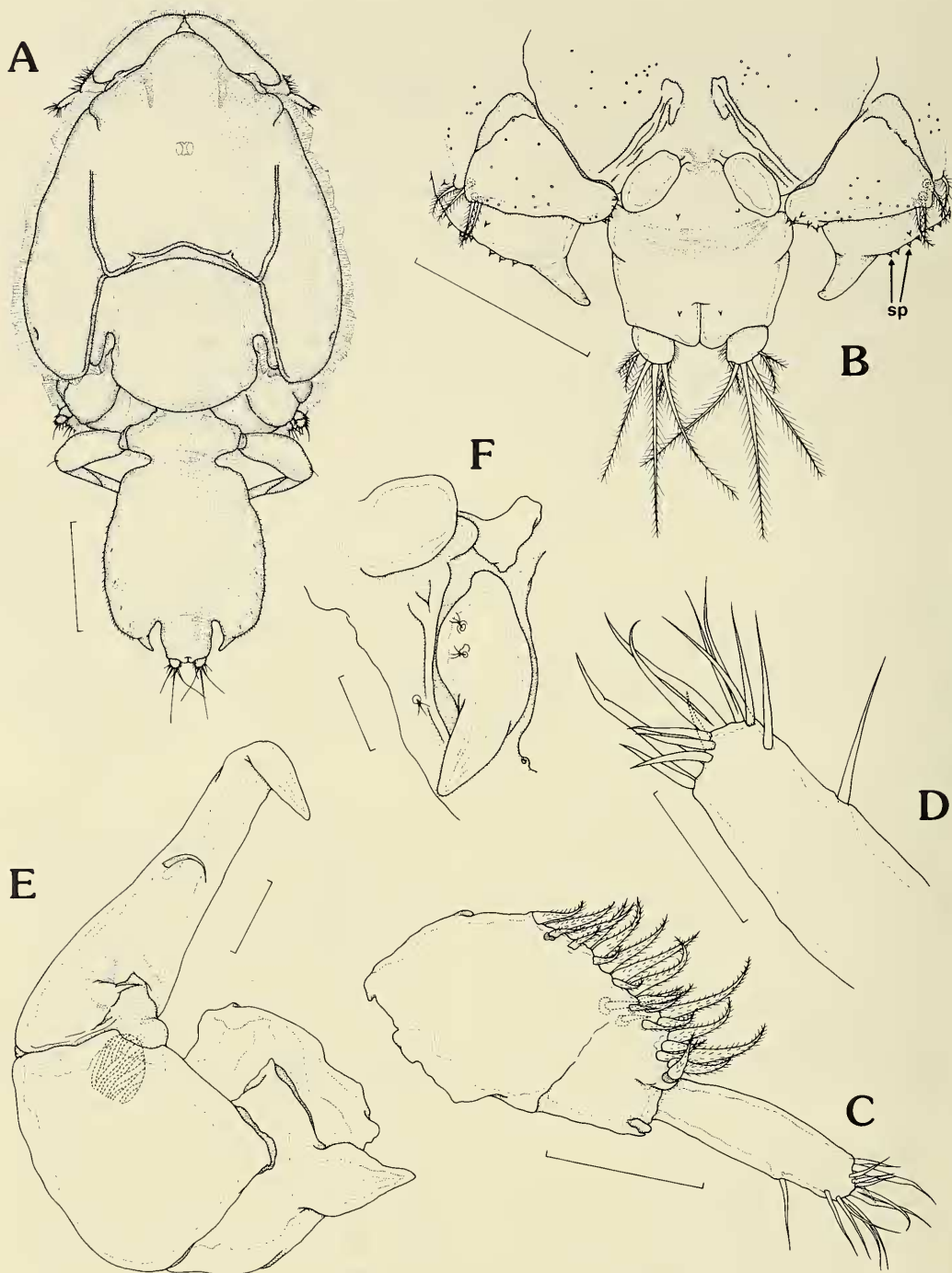


Fig. 1. *Lepeophtheirus spatha*, new species, female: A, habitus, dorsal; B, posterior portion of urosome, ventral; C, first antenna, ventral; D, tip of first antenna, ventral; E, second antenna, ventral; F, postantennal process, ventral. Symbol: sp = spinulated papillae. Scales: 1.0 mm in A; 0.5 mm in B; 0.2 mm in C; 0.1 mm in D-F.

station A7, 33°56'15"N, 118°27'28"W, in 15 m, 02 Nov 1989.

Female.—Body as in Fig. 1A. Total length (excluding setae on caudal ramus) 6.07 mm (6.02–6.16 mm) based on 3 specimens. Cephalothorax ovoid, 3.67 mm (3.62–3.77 mm) × 3.05 mm (2.96–3.16 mm). Frontal plate well-developed. Fourth pedigerous segment 3× wider than long, 0.40 mm (0.35–0.46 mm) × 1.21 mm (1.16–1.24 mm). Genital complex subquadrangular with rounded corners and convex lateral margins, longer than wide, 1.62 mm (1.52–1.70 mm) (excluding posterior process) × 1.52 mm (1.49–1.57 mm), armed with spinulated papillae on lateral margins (Fig. 1B), and bearing posterior processes. Abdomen 1-segmented, wider than long, with 2 medial pairs of setules, 0.35 mm (0.33–0.38 mm) × 0.45 mm (0.43–0.49 mm). Caudal ramus (Fig. 1B) about as long as wide, 0.10 mm (0.09–0.11 mm) × 0.11 mm (0.10–0.12 mm), and bearing 6 pinnate setae. First antenna (Fig. 1C) 2-segmented; first segment robust, with cuticular fold slightly beyond midlength, bearing 27 pilose setae (25 anteroventral and 2 dorsal setae) and 2 posterodistal spiniform processes; second segment (Fig. 1D) cylindrical, bearing 1 posterior subterminal seta and 13 terminal setae (2 sharing common base). Second antenna (Fig. 1E) 4-segmented; second segment with large, pointed, posteriorly directed, spiniform process; third segment stout, bearing usual dorsal adhesion process; terminal segment unguiform, bearing 2 setae (proximal one arising from small rounded protrusion). Postantennal process (Fig. 1F) relatively straight, stout, with 2 multibranching setules on the base and 1 lateral to it; 2 (1 large, 1 small) rounded processes anteromedial to postantennal process.

Mouth tube longer than wide, 440 × 320 μm. Mandible (Fig. 2A) of 4 parts (possibly representing segments); third and fourth parts indistinctly separated; fourth part bearing transparent membrane on lateral surface and 12 teeth on medial margin. First

maxilla (Fig. 2B) consisting of papilla bearing 3 setae, and 2 flanged tines of about equal length; associated sclerotized plate armed with posterior rounded process. Second maxilla (Fig. 2C) brachiform; flabellum a striated membrane at midlength of brachium; calamus with 4 serrated membranes (only 3 illustrated in Fig. 2D); canna with 1 serrated membrane and 1 smooth one. Maxilliped (Fig. 2E) with large, rounded hyaline process on inner margin; shaft and claw partially fused on dorsal surface, but clearly separate ventrally; shaft with inner distal seta. Sternal furca (Fig. 2F) flanked on each side by slightly curved spiniform process and consisting of broad spatulate tines; each tine with wide flanges.

Leg 1 (Fig. 2G) biramous; sympod (Figs. 2G, 3A) with bifid lateral setule, 1 lateral pinnate seta (base hidden by conical process, Fig. 3A), and 1 medial pinnate seta. Exopod 2-segmented; first segment (Fig. 3B) with lateral distal corner carrying spine armed with outer row of spinules and medial margin with row of setules; second segment (Fig. 3B) with 3 spines, each spine with pectinate membranes near bases (spine 1 with minutely serrated, striated flanges; spines 2 and 3 serrated and armed with hyaline, setiform, accessory processes), 1 pinnate seta on distal medial corner, and 3 large pinnate medial setae. Endopod (Fig. 3A) vestigial, tipped with 2 setiform processes (setae?). Leg 2 (Fig. 3C) with coxa (first segment of sympod; Fig. 3D) having 1 rounded flat process and 1 conical process tipped with 1 subterminal setule near intercoxal plate, 1 lateral striated membrane, and 1 medial pinnate seta; basis with 1 naked lateral seta (Fig. 3C), 1 naked medial setule, and 1 medial striated membrane. Exopod (Fig. 3E) 3-segmented with formula I-1, I-1, II,I,5, and striated membrane on dorsal lateral margin; first exopodal spine with minutely serrated membrane at base; first and second exopodal spines with minutely serrated flanges along outer and inner margins; terminal segment with 1 spine, similar to those of first and second exopodal segments, 1

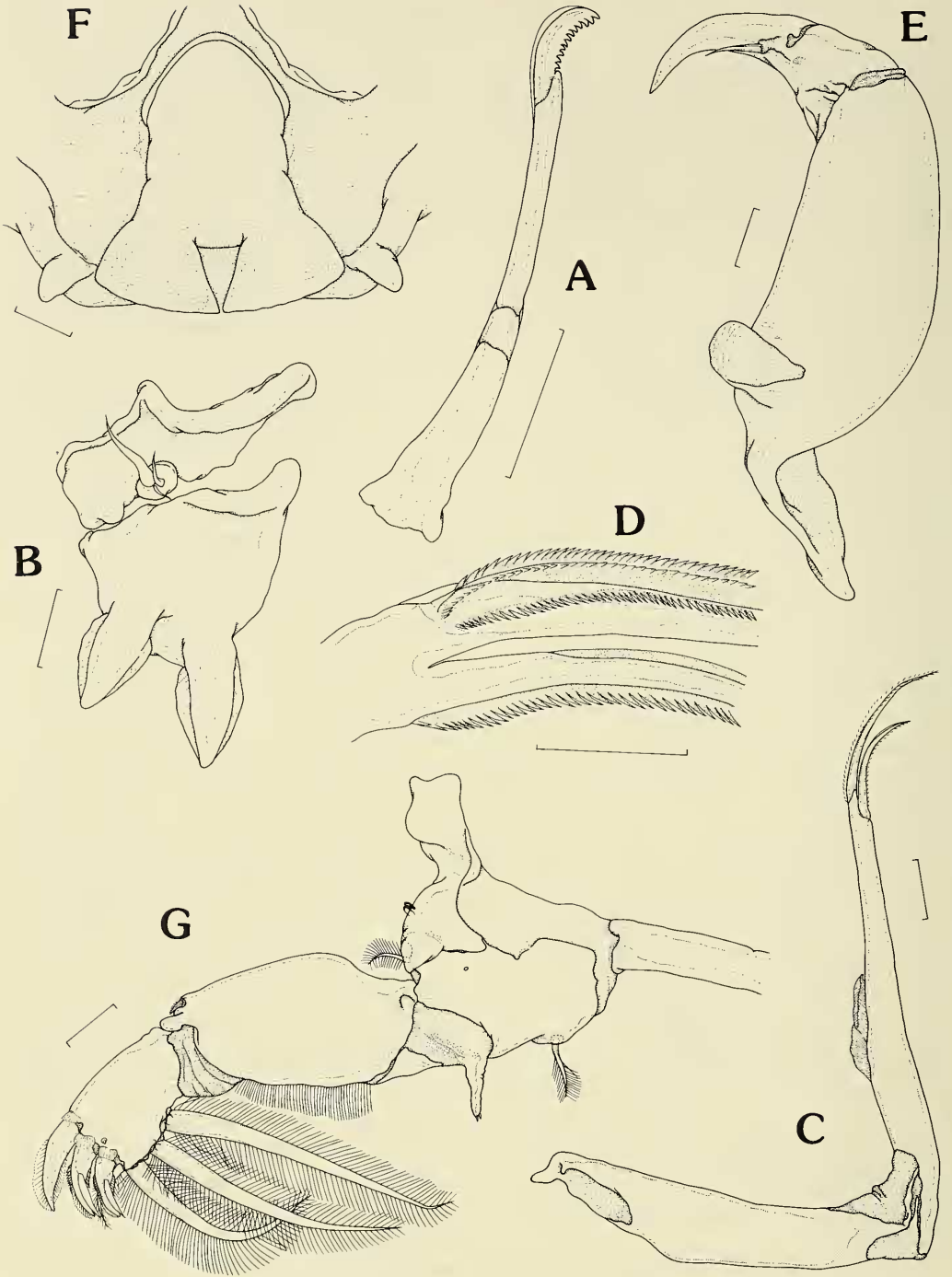


Fig. 2. *Lepeophtheirus spatha*, new species, female: A, mandible, ventral; B, first maxilla, ventral; C, second maxilla, dorsal; D, tip of second maxilla, ventral; E, maxilliped, ventral; F, sternal furca and spiniform processes, ventral; G, leg 1 and intercoxal plate, ventral. Scale: 0.1 mm in A-C, E-G; 0.05 mm in D.

curved element flanked by outer and inner transparent membranes, and 1 long setiform element with outer transparent membrane and inner row of pinnae. Endopod (Fig. 3C) with formula 0-1, 0-2, 6; first-third endopodal segments with lateral rows of setules, but only second and third segments with medial (inner) rows of setules. Leg 3 (Fig. 4A) with sympod carrying large dorsal corrugated adhesion pad, striated marginal membrane, 1 lateral pinnate seta (dorsal to insertion of exopod), 1 medial pinnate seta, and 1 large naked setule ventral to insertion of medial seta. Exopod (Fig. 4B) 3-segmented; large exopodal spine (Fig. 4C), with conspicuous lateral flanges, subterminally situated on basal swelling which carries 3 setules (dorsal one bifid) and terminal striated membrane; 1 pinnate seta (between insertion of exopod and endopod) presumably representing medial seta of first exopodal segment; second and third segments with formula I-1, III,4 (outermost seta conspicuously larger than other 3), and having rows of setules on lateral and medial margins. Endopod (Fig. 4B) 2-segmented; first segment slightly expanded laterally, with lateral row of setules and medial pinnate seta; second segment with lateral and medial rows of setules and 6 pinnate setae. Leg 4 (Fig. 4D) with sympod bearing several setules and 1 distal pinnate seta; exopod distinctly 3-segmented with formula I, I, III; each exopodal segment with outer margin bearing serrated membrane; each spine with pectinate (minutely serrated) membrane near base; spine of first exopodal segment small and naked; spine of second exopodal segment with serrated flanges; 3 spines of terminal segment (Fig. 4E) decreasing in length from inner to outer margin, with innermost spine bearing only 1 serrated flange. Leg 5 (Fig. 4F) a broad subtriangular plate with 3 pinnate setae and several papillae tipped with spinules; 1 additional pinnate seta lateral to this complex.

Male.—Body as in Fig. 5A. Total length 3.35–5.06 mm and width 1.82–2.58 mm based on 2 specimens. Cephalothorax sub-

oval, 2.23–2.86 mm × 1.82–2.58 mm. Fourth pedigerous segment much wider than long, 0.28–0.33 mm × 0.63–0.92 mm. Genital complex wider than long, 0.52–0.59 mm × 0.79–0.90 mm. Abdomen 1-segmented, 0.23–0.37 mm × 0.29–0.43 mm. Caudal ramus armed as in female, as long as wide, 0.09–0.12 mm × 0.09–0.12 mm. Appendages as in female except those described below.

Second antenna (Fig. 5B, C) 3-segmented; first segment with 2 corrugated adhesion pads; second segment with 5 adhesion pads, distalmost pad (Fig. 5B, E) suboval and consisting of stack of lamelliform structures rimmed with striated membranes; third segment (Fig. 5D, E) curved claw with 1 hyaline seta and rounded process (Fig. 5E) on ventral surface near base, 1 seta on medial margin, and 2 longitudinal flanges on dorsal surface (Fig. 5D) and 2 on ventral surface (Fig. 5E). First maxilla (Fig. 5F) with rounded tines and 1 medial, hyaline, digitiform process; this process with subapical accessory lobe on 1 specimen examined (Fig. 5F), but accessory lobe absent on other males. Sternal furca (Fig. 5G) with blunt tips, not markedly truncate as in female.

Legs 5 and 6 (Fig. 5H) conical lobes, bearing 4 and 3 pinnate setae, respectively.

Coloration.—Live specimens are opaque, light tan with bright purple pigment concentrated along the borders of the cephalothorax and genital complex; pigmentation fades with preservation.

Etymology.—The specific name *spatha*, a Latin feminine noun meaning broad sword without point, alludes to the broad truncate tines of the sternal furca of the female; it stands as a feminine singular noun in apposition to the generic name.

Remarks.—*Lepeophtheirus spatha*, new species, can be distinguished from all its congeners by the possession of posterior processes on the genital complex of the female, the truncate sternal furcal tines, and the subtriangular leg 5 in the female.

Two species, *L. pravipes* Wilson, 1912 and *L. semicossyphi* Yamaguti, 1939 (see Ka-

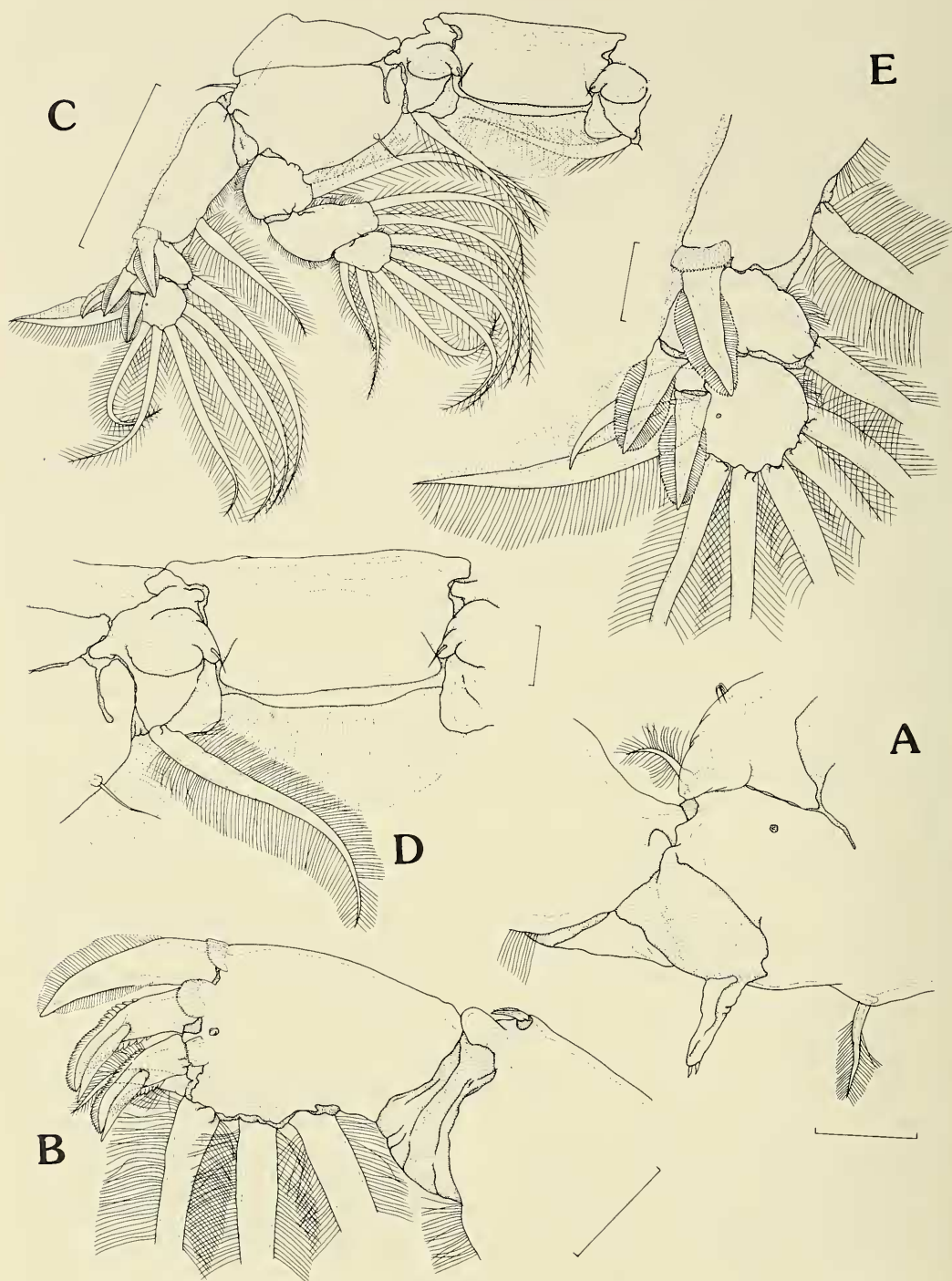


Fig. 3. *Lepeophtheirus spatha*, new species, female: A, sympod-exopod joint of leg 1, ventral; B, tip of leg 1, ventral; C, leg 2 and intercoxal plate, ventral; D intercoxal plate and proximal portion of coxa of leg 2, ventral; E, tip of leg 2 exopod, ventral. Scale: 0.1 mm in A, B, D, E; 0.5 mm in C.

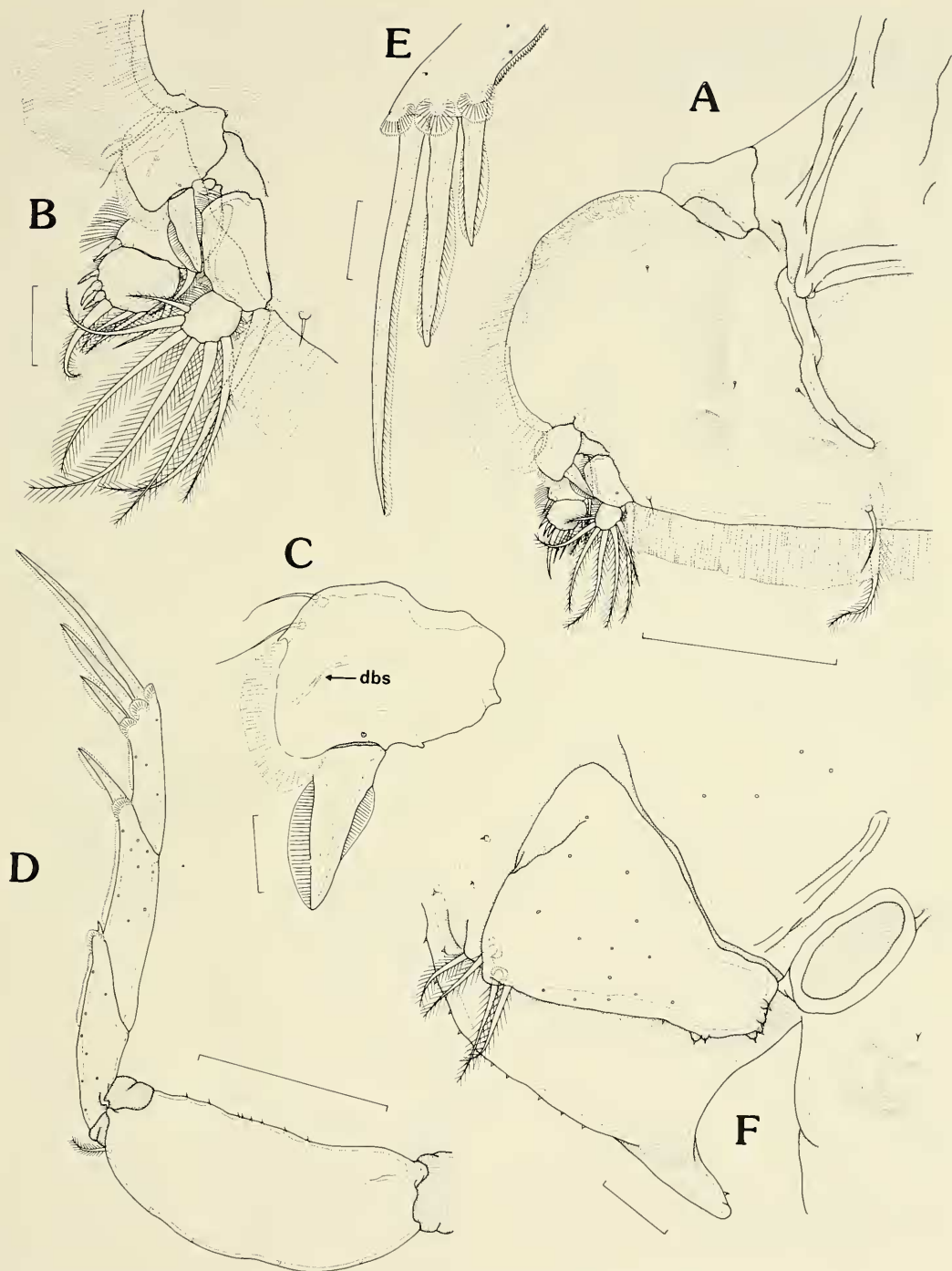


Fig. 4. *Lepeophtheirus spatha*, new species, female: A, leg 3 and ventral apron, ventral; B, leg 3, ventral; C, exopod spine of leg 3, ventral; D, leg 4, ventral; E, tip of leg 4 exopod, ventral; F, leg 5, posterior process of genital complex, and attached spermatophore, ventral. Symbol: dbs = dorsal bifid setule. Scale: 0.5 mm in A, D; 0.1 mm in B, E, F; 0.05 mm in C.

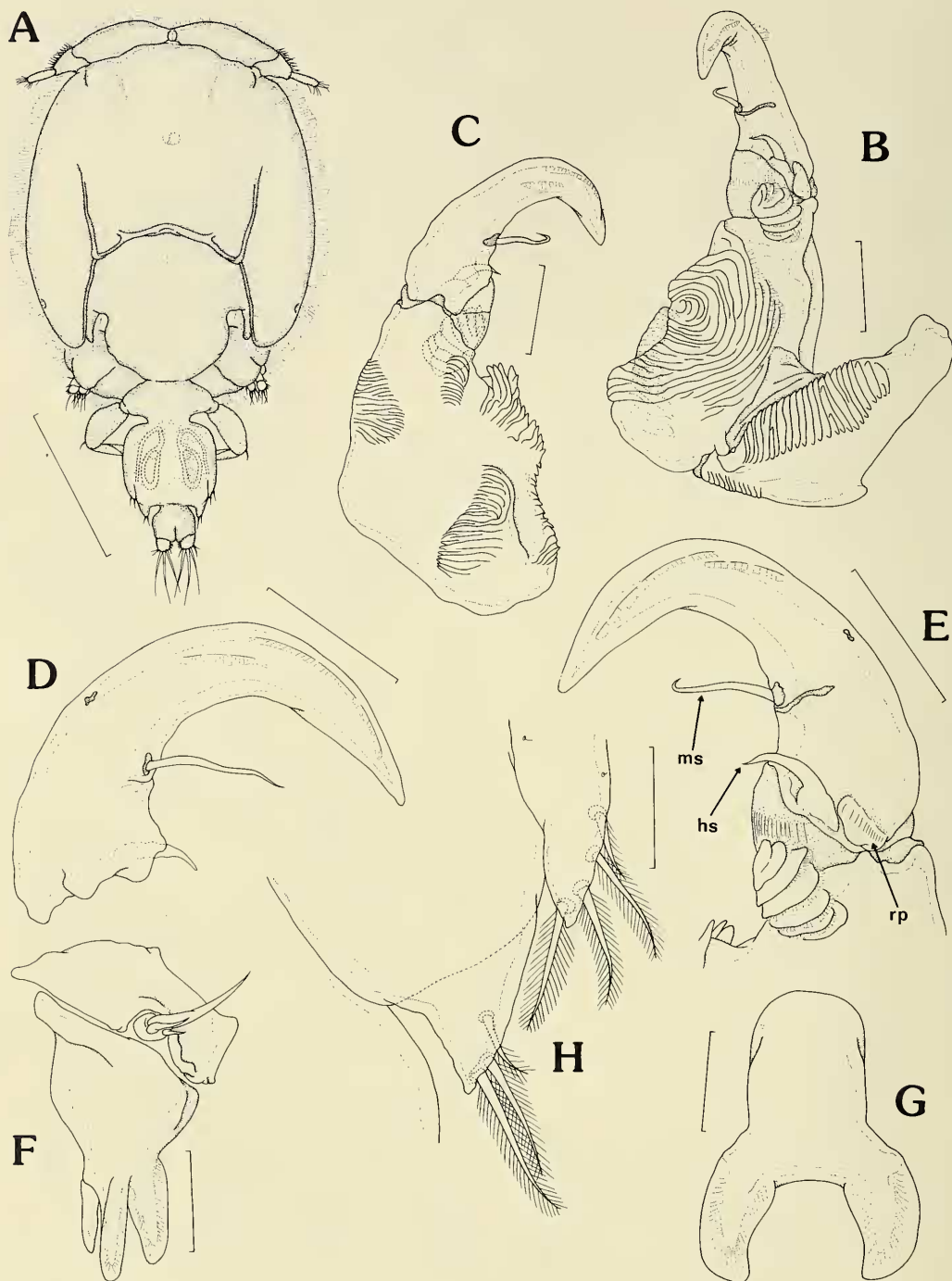


Fig. 5. *Lepeophtheirus spatha*, new species, male: A, habitus, dorsal; B, second antenna, ventral; C, distal portion of second antenna, dorsal; D, claw of second antenna, dorsolateral; E, same, ventrolateral; F, first maxilla, ventral; G, sternal furca, ventral; H, legs 5 and 6, ventral. Symbols: hs = hyaline seta; rp = rounded process; ms = medial seta. Scale: 1.0 mm in A; 0.1 mm in B-F, H; 0.2 mm in G.

bata 1974a and Shiino 1963, respectively), have a pair of posterior processes on the genital complex and a subquadrate or subtriangular leg 5 in the female as in the new species. However, *L. spatha* differs from these two species by the truncate sternal furcal tines.

The new species appears to be most closely related to *L. paralicthydis*, first described by Yamaguti & Yamasu (1960) from *Paralicthys olivaceus* (Temminck & Schlegel) from Japan. They share a similar general habitus, sternal furca, oral appendages, legs, and the very unusual, hyaline, balloon-like process on the inner margin of the base of the maxilliped of the female. This latter morphological character appears to be unique for these two species. Also, both species were collected from the external body surfaces of the halibut genus *Paralicthys*. The new species can be distinguished from *L. paralicthydis* by the presence of posterior processes on the genital complex, an attenuate basal spiniform process on the second segment of the second antenna, pointed first maxillal tines of the female, and terminal exopodal spines of leg 4 decreasing in length from the inner to the outer margin (outer two spines equal in *L. paralicthydis*).

The conical process on the inner margin of the leg 2 coxa, adjacent to the intercoxal plate, is reminiscent of that described for *L. cuneifer* Kabata, 1974 (see Kabata 1974b: 46, fig. 15). The new species, however, has a semicircular lamelliform process adjacent to this conical process on the coxa; this flat process is unique to this species.

Attempts to obtain the type specimens or newly collected material of *L. paralicthydis* for an examination of this species were futile. The type specimens could not be located and are presumably lost. Our Japanese colleagues were not able to find *L. paralicthydis* from freshly collected hosts. Apparently, this species of copepod is rare. Examination of preserved *Paralicthys olivaceus* housed in the Division of Fishes, National Museum of Natural History, Smith-

sonian Institution, by Smithsonian scientists also did not yield specimens of this species. A detailed redescription of *L. paralicthydis* is still needed, but could not be provided herein.

Acknowledgments

We thank Dr. R. F. Cressey, Dr. F. D. Ferrari, and Ms. P. L. Rothman, Smithsonian Institution, for examining preserved specimens of *P. olivaceus* for *L. paralicthydis* at the National Museum of Natural History, Smithsonian Institution. We are grateful to Dr. K. Izawa, Faculty of Fisheries, Mie University, Dr. K. Nagasawa, Hokkaido Fisheries Experimental Station, Dr. I. Takeuchi, Otsuchi Marine Research Center, University of Tokyo, and Dr. S. Uye, Faculty of Applied Biological Science, Hiroshima University for attempting to obtain new specimens of *L. paralicthydis*. This study was partially funded by grant number 91-1 from the Southern California Association of Marine Invertebrate Taxonomists and is contribution number 4 of this association.

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Environmental Monitoring Division,
Hyperion Treatment Plant, 12000 Vista del
Mar, Playa del Rey, California 90293,
U.S.A.